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Abstract

OPTICAL AND THERMODYNAMIC PROPERTIES OF MIXED SULFATE AND NITRATE AEROSOLS

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Inorganic sulfates and nitrates in either pure or mixed forms constitute a major fraction of the ambient aerosol, which is formed from both natural and anthropogenic sources. It is well known that aerosol plays an important role in atmospheric processes affecting the local air quality and visibility. In addition, tropospheric aerosol contributes substantially to radiative forcing in an opposite manner to the green-house gases, thereby imposing a cooling effect to global climate change. Extensive optical and thermodynamic data are thus required as input to mathematical models predicting the dynamic behavior, visibility reduction, and radiative effects of atmospheric sulfate and nitrate aerosols.

Using the single-particle levitation technique, in conjunction with Mie resonance spectroscopy, we have measured the refractive indices, densities, and water activities of solution droplets containing either single or mixed salts of $(NH_4)_2SO_4$, Na_2SO_4, and $NaNO_3$. The single-particle levitation technique makes it possible to measure these properties over the supersaturated concentration region heretofore inaccessible for measurement with bulk samples. While density and water activity data are presented in the form of polynomials in solute wt%, the refractive index data are given in the form of partial molal refraction, which may be used for predicting the optical properties of a complex aerosol system. The data formats chosen here can be simply and directly incorporated into modelling computations.